

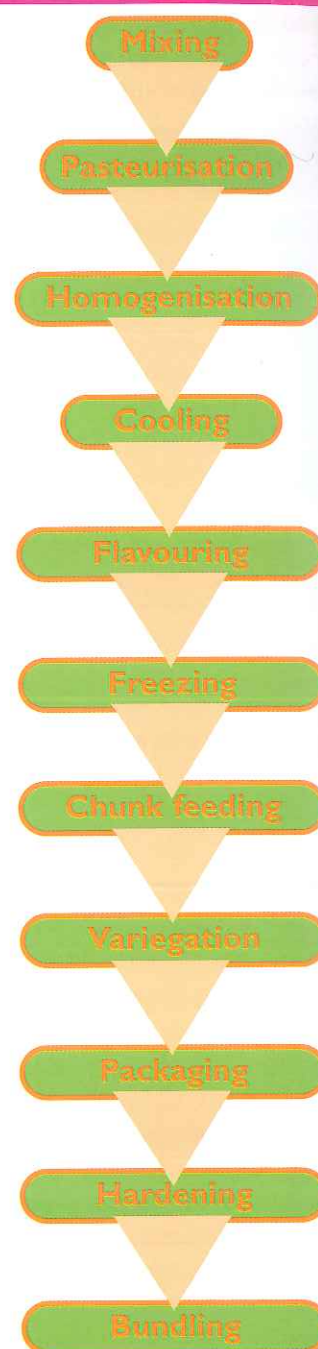
agent (40 degrees below zero). Each freezer can handle over 700 gallons of ice cream mix per hour.

- **Chunk feeding** Any fruits, nuts, sweets or biscuit bits are added to the semi-frozen mixture at this point. However, smooth ice creams would by-pass this process.
- **Variegation** This is the process that adds the swirls to Ben and Jerry's ice cream. The frozen mix passes through a variegator where swirls of marshmallow, fudge, peanut butter or caramel, for example, are injected into the ice cream.
- **Packaging** After the chunks and swirls are added, the ice cream is ready for dispensing into pint containers. This is done using an automatic filler. This piece of machinery fills about 120 cartons per minute.
- **Hardening** Before the ice cream can be stored or distributed it needs to be frozen further from its semi-frozen state to a fully frozen state of 10 degrees below zero. A spiral hardener is used in this process where the wind speed temperature inside the machine's tunnel is 60 degrees below zero.
- **Bundling** This is the final stage in the production process and involves shrink wrapping the pint cartons into bundles of eight which are then stacked on pallets ready for transportation to storage.

Source: adapted from [www.benjerry.com](http://www.benjerry.com).

- Explain why the production of Ben and Jerry's ice cream is an example of secondary production. (4 marks)
- Outline the possible role of a production planner at Ben and Jerry's factory. (6 marks)
- Using ice cream production as an example, explain what is meant by (i) inputs (ii) processes (iii) outputs. (12 marks)
- Explain how Ben and Jerry's add value when producing ice cream. (8 marks)
- Discuss two possible production decisions that Ben and Jerry's might have to make. (10 marks)

Figure 4: The processes involved in the production of Ben and Jerry's ice cream



# 81 Types of production

## Deciding how to produce

A business must decide on the most suitable method to manufacture its goods or to provide services. It is likely that products which are different will be produced differently. For example, a plastic drinks bottle may be produced using automated machinery, but a wrist watch may be assembled by hand. Products that are similar can also be produced in different ways. The Ford Motor Company and Morgan Cars both produce cars, but different processes are used. Ford builds cars using a production line and semi-skilled labour, but Morgan cars are hand built by skilled workers. There are three important decisions that businesses must make when choosing how to produce. These are shown in Figure 1, along with the factors which influence these decisions. In the diagram it is assumed that the firm has already decided 'what' to produce. When deciding how to produce, the objective of the firm will be to minimise the cost per unit of output, i.e. PRODUCTIVE EFFICIENCY.

**What production method will be used?** Production is sometimes divided into one of three methods. JOB PRODUCTION is where one job is completed at a time before moving on to another. An example might be a costume made

for a television play set in the nineteenth century. BATCH PRODUCTION involves dividing the work into a number of different operations. An example would be bread production, where each batch goes through several different baking stages before it is completed. FLOW PRODUCTION involves work being completed continuously without stopping. The production of cars on a production line might be one example.

Some industries may combine different methods of production. For example, a large brewery may produce 'batches' of beer, but then send them to a bottling line for packaging, where flow production is used. Such combinations are particularly common in the food industry.

**What factors of production will be used?** Businesses are often faced with a wide choice between alternative production factors. For example, a builder planning to construct a new house must decide what building materials to buy, which tools to use, which sub-contractors to employ and whether to hire any extra labour. The builder will be faced with a choice in all of these cases. If he decides to hire a labourer, there may be hundreds or even thousands of people to choose from in the area.

**How will the factors of production be combined?** A third production decision concerns the way in which the available production factors should be combined. For example, should an assembly plant invest in a highly automated assembly operation, or employ a large semi-skilled labour force to undertake the work?

This unit focuses on the types of production a business might choose from.

## Job production

Job production involves the production of a single product at a time. It is used when orders for products are small, such as 'one-offs'. Production is organised so that one 'job' is completed at a time. There is a wide variety of goods and services which are produced or provided using this method of production. Small-scale examples include the baking of a child's birthday cake, a dentist's treatment session or the construction of an extension to a house. On a large scale, examples could include the building of a ship, the construction of the Channel Tunnel or the manufacture of specialised machinery. Job production is found in both manufacturing and the service industries. Because the numbers of units produced is small, the production process tends to be labour intensive. The workforce is usually made up of skilled craftsmen or specialists and the possibility of using labour-saving machinery is limited. Many businesses adopt this method of production when they are 'starting up'. The advantages and disadvantages of job production are shown in Table 1.

Figure 1: Factors which affect the decision about how to produce

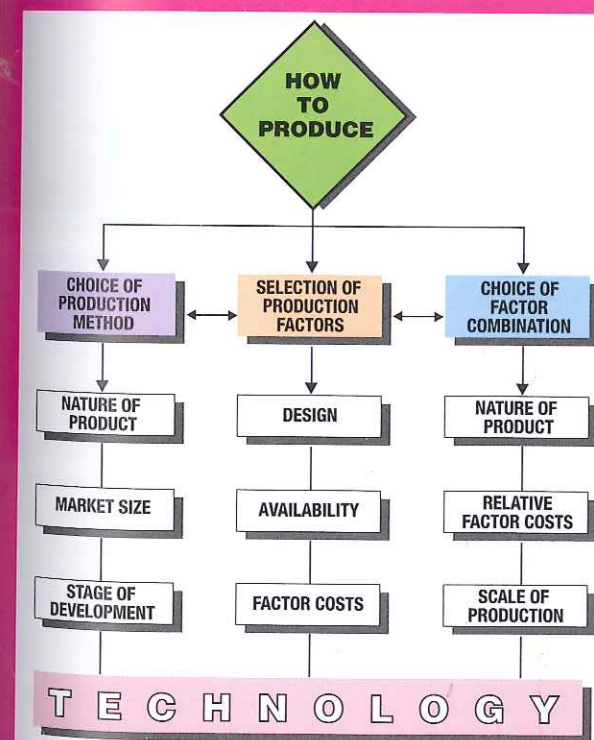




Table 1: Advantages and disadvantages of job production

**Advantages**

- Firms can produce unique or 'one-off' orders according to customer needs. For example, a wedding dress may be designed and produced for the individual taste of a client. It is also possible to change the specifications of a job at the last minute, even if the work has actually begun.
- Workers are more likely to be motivated. The tasks employees carry out often require a variety of skills, knowledge and expertise. Their work will be more demanding and interesting. They will also see the end result of their efforts and be able to take pride in their work. Jobs may be carried out by a team of workers aiming to achieve the same objectives. This should help raise the level of job satisfaction.
- The organisation of job production is fairly simple. Because only one job is done at a time, co-ordination, communication, supervision and inspection can take place regularly. Also, it is easier to identify and deal with problems, such as a defective damp proof course in a house or a poorly cooked meal in a restaurant.

**Disadvantages**

- Labour costs will be high because production tends to be labour intensive. The workforce is likely to be skilled and more versatile. Such employees will be more expensive. The amount of time each employee spends on a particular job will also be long.
- Because there is a variety of work, subject to many specifications, the business would need a wide range of tools, machines and equipment. This can prove expensive. Also, it may not be possible to achieve economies of scale because only one 'job' is produced at a time.
- Lead times can be lengthy. When building a house, the business has to incur costs which cannot be recovered until the house is sold. Sometimes the sale of a house can take a long time.
- Selling costs may also be high. This is likely if the product is highly complex and technical. The sales team will need to be well qualified, able to cope with questions and deal with problems concerning sales and installation. Some firms employ agencies to help reduce their selling costs.
- Once the demand for a firm's product rises, job production may become costly. Firms may prefer to use a method more suited to producing larger quantities. This is not always the case. Even if demand is high, each customer may require a unique order. In addition, many firms believe that the 'personal touch' they can offer in job production is important. As a result, they may choose not to change to other production methods. Other production methods require some degree of product standardisation. This may result in more efficient production, but a loss of 'individuality'.

Table 2: Operations involved in the production of a batch of bread

1. Blend ingredients in a mixing container until a dough is formed.
2. Knead the dough for a period of time.
3. Leave the dough to rise for a period of time.
4. Divide the dough into suitable units (loaves) for baking.
5. Bake the loaves.
6. Allow loaves to cool.

**Batch production**

Batch production may be used when demand for a firm's product or service is regular rather than a 'one off'. An example might be a furniture factory, where a batch of armchairs is made to a particular design. Production is divided into a number of operations. A particular operation is carried out on all products in a batch. The batch then moves to the next operation. A baker uses batch production when baking bread. The operations in the baking process are broken down in Table 2.

These operations would be performed on every batch of bread. There is some standardisation because each loaf in the batch will be the same. However, it may be possible to vary each batch. The ingredients could be changed to produce brown bread or the style of baking tin could be changed for different shaped loaves.

A great number of products are produced using this method, particularly in manufacturing, such as the production of components and food processing. For example, in a canning plant, a firm may can several different batches of soup, each batch being a different recipe. Products can be produced in very large or very small batches, depending on the level of demand. Larger production runs tend to lower the **unit** or **average cost** of production. New technology is increasingly being introduced to make batch production more efficient. The advantages and disadvantages of batch production are shown in Table 3.

**Flow production**

Most people will have some idea of flow production from pictures of motor car factories. Production is organised so that different operations can be carried out, one after the other, in a continuous sequence. Vehicles move from one operation to the next, often on a conveyer belt. The main features of flow production are:

- the production of large quantities;
- a simplified or standardised product;
- a semi-skilled workforce, specialising in one operation only;
- large amounts of machinery and equipment;
- large stocks of raw materials and components.

Table 3: Advantages and disadvantages of batch production

**Advantages**

- Even though larger quantities are produced than in job production, there is still flexibility. Each batch can be changed to meet customers' wishes. It is particularly suitable for a wide range of similar products. The settings on machines can be changed according to specifications, such as different clothes sizes.
- Employees can concentrate on one operation rather than on the whole task. This reduces the need for costly, skilled employees.
- Less variety of machinery would be needed than in job production because the products are standardised. Also, it is possible to use more standardised machinery.
- It often results in stocks of partly finished goods which have to be stored. This means firms can respond more quickly to an urgent order by processing a batch quickly through the final stages of production.

**Disadvantages**

- Careful planning and co-ordination are needed, or machines and workers may be idle, waiting for a whole batch to finish its previous operation. There is often a need to clean and adjust machinery before the next batch can be produced. This can mean delays. In brewing, one day of the week is used to clean equipment before the next batch begins.
- Some machinery may have to be more complex to compensate for the lower skill levels required from the labour force. This may lead to higher costs.
- The workforce may be less motivated, since they have to repeat operations on every single unit in the batch. In addition, they are unlikely to be involved with production from start to finish.
- If batches are small then unit costs will remain relatively high.
- Money will be tied up in work-in-progress, since an order cannot be dispatched until the whole batch has been finished.

**Question 1.**

Alex Stone is a chartered accountant. He runs a small business from an office in Kidderminster producing final accounts for sole traders, partnerships and small private limited companies. He has a client base of around 110 businesses and employs a secretary and a young trainee accountant. In addition to preparing accounts He offers other services such as:

- completing tax returns;
- taxation planning;
- advice on the financial management of businesses;
- advice on investment;
- auditing.

- (a) Use this case as an example to explain what is meant by job production.
- (b) Explain why job production might help to motivate Alex and his trainee.

Flow production is used in the manufacture of products as varied as newspapers, food and cement. It is sometimes called **mass production**, as it tends to be used for the production of large numbers of standard products, such as cars or breakfast cereals. Certain types of flow production are known as **continual flow production**, because products such as clothing material pass continually through a series of processes. **Repetitive flow production** is the manufacture of large numbers of the same product, such as plastic toy parts or metal cans.

The advantages and disadvantages of flow production are shown in Table 4. In the 1990s flow production processes were changed in an attempt to solve some of the problems. Japanese manufacturers setting up businesses in the UK introduced methods to improve efficiency. Just-in-time manufacturing, for example, helped to reduce the cost of holding stocks. Some vehicle manufacturers attempted to introduce an element of job production into flow processes by **customising** products for clients. For example, a range of different cars was produced on the same production line. Cars in the same model range differed in colour, engine size, trim and interior design.

**Process production**

**PROCESS PRODUCTION** is a form of flow production which is used in the oil or chemical industry. Materials pass through a plant where a series of processes are carried out in order to change the product. An example might be the refining of crude oil into petrol.

Flow production relies on the use of computers. Computers send instructions to machines, control production speeds and conditions, and monitor quality. They allow large numbers of products to be produced continuously to exact standards or control continuous production, which requires many processes.



Table 4: Advantages and disadvantages of flow production

**Advantages**

- Unit costs are reduced as firms gain from economies of scale.
- In many industries the process is highly automated. Production is controlled by computers. Many of the operations are performed by robots and other types of machinery. Once the production line is set up and running, products can flow off the end non stop for lengthy periods of time. This can reduce the need for labour, as only machine supervisors are needed.
- The need to stockpile finished goods is reduced. The production line can respond to short-term changes in demand. For example, if demand falls the line can be shut down for a period of time. If it rises then the line can be opened.

**Disadvantages**

- The set-up costs are very high. An enormous investment in plant and equipment is needed. Firms must therefore be confident that demand for the product is sufficient over a period of time to make the investment pay.
- The product will be standardised. It is not possible to offer a wide product range and meet different customers' needs. However, modern machinery is becoming more flexible and is beginning to overcome this problem.
- For a number of reasons, worker motivation can be a serious problem. Most of the manual operations required on the production line will be repetitive and boring. Factories with production lines tend to be very noisy. Each worker will only be involved in a very small part of the job cycle. As a result of these problems worker morale may be low and labour turnover and absenteeism high.
- Breakdowns can prove costly. The whole production system is interdependent. If one part of the supply or production line fails the whole system may break down.

**Choice of production method**

The method of production chosen might depend on a number of factors.

**The nature of the product** Many products require a specific method of production. For example, in the construction industry, projects such as bridges, roads, office blocks and sewers must be produced using job production. Cereal farming involves batch production. A plot of land undergoes several processes before it 'produces' a crop.

**The size of the market** Fast-moving consumer goods like soap, confectionery and canned drinks are normally produced using flow production because the market is so big. When the market is small, flow production techniques are not cost effective.

**The stage of development a business has reached** When firms are first set up, they often produce small levels of output and employ job or batch production methods. As they grow and enjoy higher sales levels, they may switch to flow production.

**Technology** The current state of technology will affect all decisions concerning how to produce. As technology advances, new materials and machinery become available. Changes in technology often result in firms adopting new methods of production. For example, the development of computers and robotic welders has radically changed the way in which cars are manufactured. Also, car manufacturers are now able to produce different models on the same production line at the same time.

**Question 2.**

Uniform+ was established in 1997 and has become a leading supplier of workwear, leisurewear and promotional clothing to businesses and organisations across the UK. In 2006, the company moved to a purpose-built freehold head office and factory in Cannock. Uniform+ supplies over 12,000 garments a week to more than 5,500 customers. The company has an excellent reputation in the industry because of their:

- commitment to offering a wide choice of quality clothing at unbeatable prices;
- dedication to providing excellent customer service and value for money;
- fast turnaround and flexibility to meet customers' needs;
- unique free logo and delivery service.

Like most companies in the clothes industry, Uniform+ uses batch production. The company can meet a wide range of different orders due to the flexibility of its machinery and its multi-skilled workforce.

- Use the clothes industry as an example to explain what is meant by batch production.
- Why is batch production common in the clothes industry?
- How do you think Uniform+ has overcome some of the typical problems associated with batch production?

**KEYTERMS**

**Batch production** – a method which involves completing one operation at a time on all units before performing the next.

**Flow production** – very large scale production of a standardised product, where each operation on a unit is performed continuously, one after the other, usually on a production line.

**Job production** – a method of production which involves employing all factors to complete one unit of output at a time.

**Process production** – a form of flow production where materials pass through a plant where a series of processes are carried out in order to change the product.

**Productive efficiency** – production methods which minimise unit costs.

**Case Study: Nacional**

Nacional is a major breakfast cereal manufacturer in Portugal and forms part of the grain milling Amorim-Lage Group. The popularity of breakfast cereals has grown in Portugal in recent years and one of Nacional's main production facilities was in need of a major update and expansion using new technology and new ideas. Early in 2004, Nacional carried out a major refit and expansion plan that was completed by mid-September. The investment in the new facility was estimated at 11.2 million euros.

Nacional's main product was cornflakes but since the expansion the facility has been able to manufacture a variety of extruded breakfast cereal products for marketing under its own brand names and also for supermarket own-brand labels. The adoption of extrusion techniques (drawing a dough mixture through a shape to produce a continuous strand with an identical cross section which can be cut into shapes such as stars or squares for example) in processing breakfast cereal at the Nacional plant has widened the production possibilities because a variety of grains can now be used. This has allowed the blending of different grains into unique cereal pieces. Extrusion has also made production more efficient by combining several processing steps into a single, continuous flow.

PV Baker has supplied and installed a complete processing plant for Nacional. It incorporates the entire production process, from

**KNOWLEDGE**

- What are the three main decisions which have to be made regarding the method of production?
- Under what circumstances might a business become more capital intensive?
- State three types of products which may be manufactured using job production.
- Describe the advantages and disadvantages of job production.
- State three products that are generally manufactured using batch production.
- Describe the advantages and disadvantages of batch production.
- Describe four features of flow production.

compounding and mixing the recipe 'dough' through extrusion and cooking to drying and coating the final extruded product shapes. The new facility can make a variety of different products, including corn-balls, coco-balls, choco curls, golden squares, stars and rings, as well as co-extruded filled pillow shapes. All of these extruded shapes, except the pillows, will be coated with a honey, sugar or glucose based glaze.

Most of the products are cut into individual pieces by a die as they leave the extruder. A key design feature of the facility is the ability to change over rapidly between products in response to market demand, including those products involving different raw materials and syrup. For example, to create filled pillow products, which cannot be cut at the die, a mobile crimping unit is wheeled in and out of the line.

Source: adapted from [www.foodprocessing-technology.com](http://www.foodprocessing-technology.com)

- State four processes used in the production of breakfast cereals at Nacional. (4 marks)
- Explain how Nacional is using both batch production and flow production methods in its factory. (10 marks)
- When upgrading its production facilities, what role did technology play at Nacional? (6 marks)
- To what extent do you think the 11.2 million euro investment will benefit Nacional? (20 marks)